

Recent Advances and Plans in Processing and Geocoding of SAR Data at the DFD

W. Noack

German Aerospace Research Establishment (DLR)

German Remote Sensing Data Center, DFD

W-8031 Oberpfaffenhofen, Germany

N 94-15909
182863
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1. Introduction

Because of the needs of the future projects like ENVISAT and the experiences made with the current operational ERS-1 facilities a radical change in the SAR processing scenarios can be predicted for the next years. At the German PAF several new developments have been initialized which are driven mainly either by user needs or by system and operational constraints ("lessons learned").

At the end there will be a major simplification and uniformation of all used computer systems. Especially the following changes are likely to be implemented at the German PAF:

transcription before archiving, processing of all standard products with high throughput directly at the receiving stations, processing of special "high-valued" products at the PAF, usage of a single type of processor hardware, implementation of a large and fast on-line data archive and improved and unified fast data network between the processing and archiving facilities.

In the following a short description of the current operational SAR facilities as well as the future implementations will be given.

2. Archiving and Catalogue System

At present, archiving of SAR products from ERS-1 and later on also from X-SAR is done using Archival Optical Disks (WORMS) with a capacity of 2 GByte per disk. The disk drives are installed at each processing system and the disks are carried by hand to the facility where they are needed. The main disadvantages are the slow throughput, the limited storage capacity, the susceptibility to operator errors and the high maintenance requirements of the drives.

An improvement of this situation is represented by the Epoch-1 system, which consists of a mixture of non-erasable and erasable disks with a total on-line capacity of 400 GByte. The system is used for many projects, among them are the storage of AVHRR data and the background storage for the image processing laboratories. But there are still the disadvantages of relatively slow throughput and the limited storage capacity. Also, this system would not be able to guarantee the on-line access of one year ERS-1 PAF production of SAR and Geocoding which is actually more than 400 GByte.

Therefore, in view of ERS-2 and ENVISAT the next generation archiving system is being studied. During a first analysis of the market two systems have been selected for a detailed investigation, of which the one system allows a total on-line capacity of up to 10.000 TByte. The study is carried out in 1993 with the goal of having the first unit installed and operational end 1994.

Due to historic reasons there are a variety of catalogues for the different kind of sensors. The biggest catalogue is the one for ERS-1. In near future these catalogues will be accessible by a recently developed common user interface. This interface is also considered to be available for external SIR-C/X-SAR users and shall be implemented before the second SIR-C/X-SAR mission, depending on availability of funding.

3. Processing

With respect to processing two major milestones have been achieved within the last year: first the Multisensor SAR Processor MSAR has become operational for ERS-1 beginning '92 and second the precision processor of the X-SAR PAF has been accepted in December '92. The following two figures are showing the hardware and the software block diagram of the XPS system. A SUN UNIX computer enhanced by an array processor of STAR Technologies with direct access to the solid state Corner Turn Memory are the major hardware units of the processor. The X-SAR data will be read in from a SONY recorder using a real time capable Frame Synchronizer and Formatter.

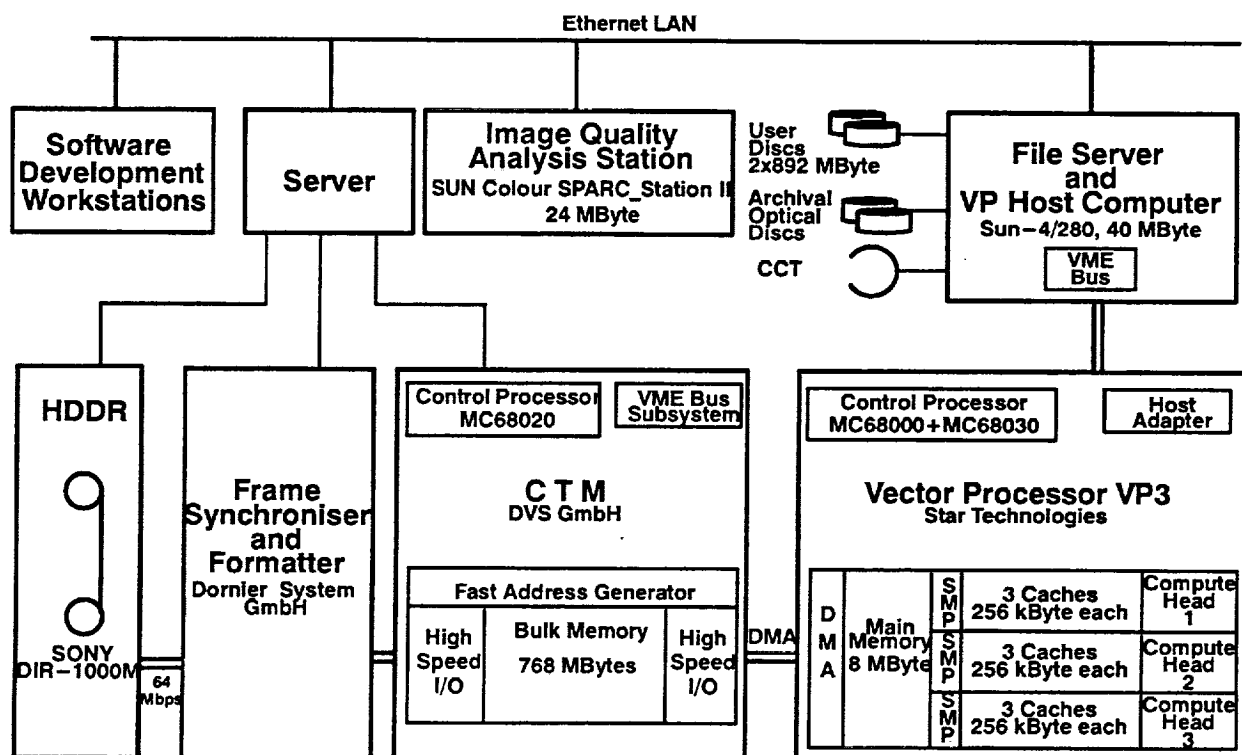


figure 1: XPS hardware block diagram

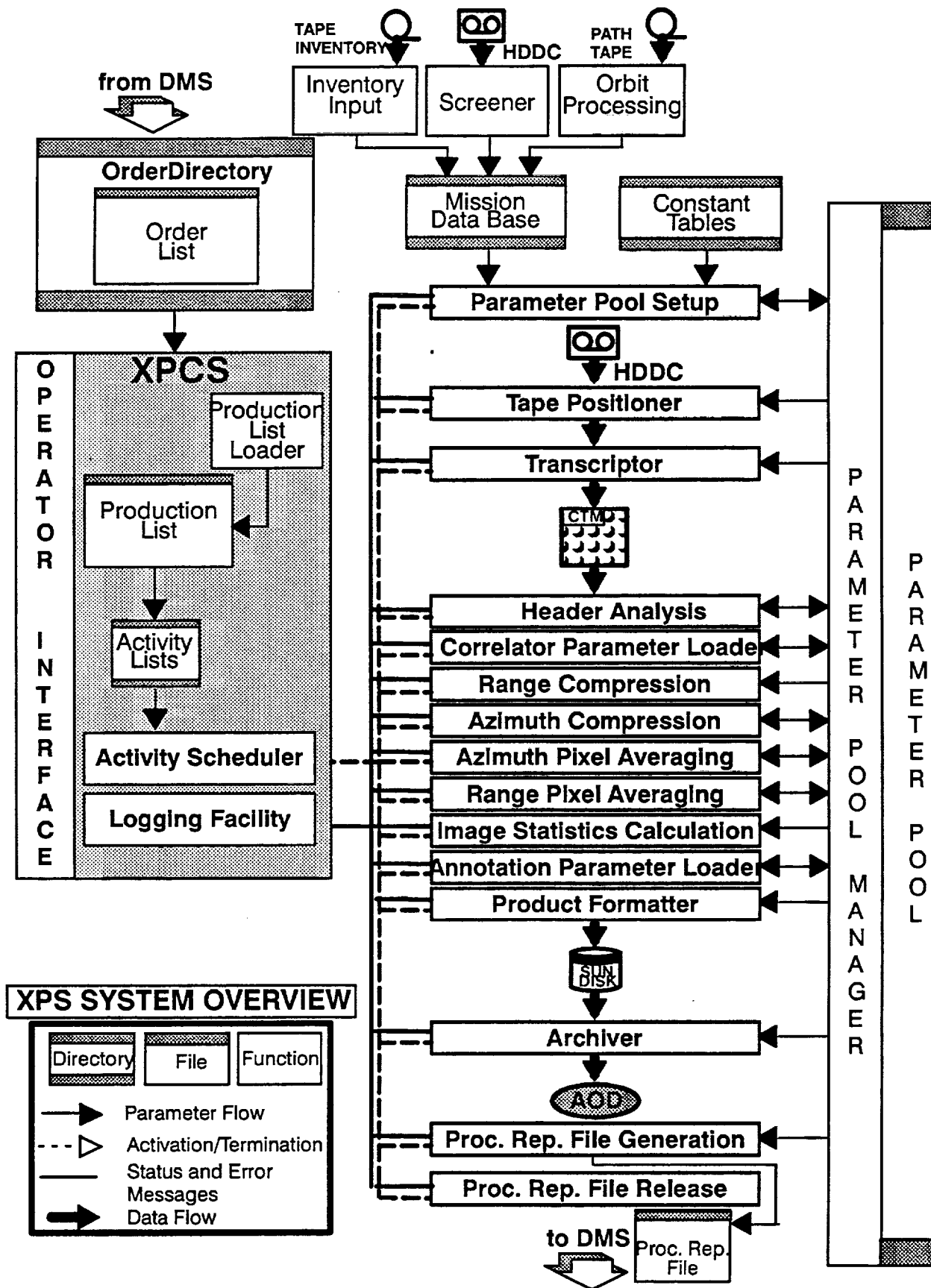


figure 2: XPS software block diagram

The software structure of the XPS is shown in figure 2 above. The Control System allows among many other options especially automatic and parallel processing of three different orders which are divided in the steps Transcription, Processing, and Archiving. The Control System has been accepted already and is since then in operational use. The Correlator has been accepted also and is in the integration phase. It uses the slightly modified and supplemented Range-Doppler algorithm. The other subsystems are either in the final acceptance phase (Formatter, Archiver) or in the design and development phase (Screener, Transcriptor).

In opposition to ERS-1, where the MSAR Screener is mainly used for archiving and quality estimation of raw data, the Screener of the XPS system is designed as a preprocessor of the Correlator and covers many different tasks. Among these are the Doppler Screening, the Doppler Ambiguity Resolving, the calculation of the internal calibration parameters, the extraction of header data, the inventarisation of the tape contents, the analysis of the mission data base and the geolocation of the raw data.

Control System, Screener, Processor, Formatter, and Archiver have been written in Ada except the modules running on the array processor. This will allow for a reuse of components in a different environment in future projects.

Beginning this year a new project has been started with the goal of the development of a high precision SAR processor making use of a powerful workstation only without external devices like an array processor or a Corner Turn Memory. The system will be quite flexible with "open" interfaces between the modules allowing the easy exchange of components. It shall mainly support the development of new, higher-valued products and shall be used as a prototype processor for future sensors like ENVISAT. The programming language will again be Ada and existing software shall be reused. Especially the Control System of the XPS shall be used for the parametrisation and monitoring of processes as well as other components. Because of the foreseeable increase in compute power of workstations throughput requirements will be investigated during the first phase with low priority only. This project is in a preparatory phase. The development will be done inhouse with possible cooperation with universities or institutes.

4. Geocoding

The present Geocoding System GEOS which is in operational use for ERS-1 and which will be adapted to X-SAR runs on SUN workstations (SPARC2) and will be implemented on the new generation (SPARC10) in early 1993. The system generates mainly ellipsoid or terrain corrected products with a throughput of several products per day. Currently no batch processing facility is implemented and therefore, each product has to be generated individually.

In future it is foreseen to include the generation of the ellipsoid corrected product directly in the SAR processor and additionally direct at the receiving stations. At present the throughput of the terrain geocoded products is one item per day. The limiting factors are the time consum-

ing determination of tiepoints, the quality control and the compute power. To improve the situation the tiepoint interface will be upgraded and the quality control will be automatised.

Additionally, the list of geocoded products shall be extended by a radar mosaic, a geocoded map quadrant and coregistered data sets. Each extension requires software upgrades and will be performed in part with the support of industry and universities.

